

## ABSTRACT

**PLASTIC BALL GRID ARRAY PACKAGE WITH INTEGRAL HEATSINK**

A plastic ball grid array semiconductor package employs a metal heat spreader having supporting arms embedded in the molding cap, in which the embedded supporting arms are not directly affixed to the substrate or in which any supporting arm that is affixed to the substrate is affixed using a resilient material such as an elastomeric adhesive. Also, a process for forming the package includes steps of placing the heat spreader in a mold cavity, placing the substrate over the mold cavity such that the die support surface of the substrate contacts the supporting arms of the heat spreader, and injecting the molding material into the cavity to form the molding cap. The substrate is positioned in register over the mold cavity such that as the molding material hardens to form the mold cap the embedded heat spreader becomes fixed in the appropriate position in relation to the substrate. Also, a process for forming the package includes steps of placing the heat spreader onto the substrate such that at least one of the supporting arms of the heat spreader is affixed to the substrate using a resilient fixative such as an elastomeric adhesive, placing a mold cavity over the heat spreader, and injecting the molding material into the cavity. The elastomeric adhesive holds the heat spreader in the appropriate position in relation to the substrate during injection of the molding material, and as the molding material hardens to form the mold cap the embedded heat spreader becomes fixed in the appropriate position in relation to the substrate. In some embodiments the under surface of the heat spreader at the interface between the heat spreader and the molding compound is roughened, or includes a black copper oxide layer, to improve adhesion and contact between the heat spreader and the molding material. The invention can provide significant improvements in manufacturability and reliability in use.